國立中山大學 109 學年度
碩士暨碩士專班招生考試試題

科目名稱：商用統計學【企管系企管甲班碩士班甲組選考、乙組選考、丙組選考】

－作答注意事項－

考試時間：100 分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。

- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，不得另攜帶紙張，請衡酌作答。

- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，其後果由考生自行負擔。

- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。

- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。

- **試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。**

- **試題採雙面列印，考生應注意試題頁數確實作答。**

- **違規者依本校招生考試試場規則及違規處理辦法處理。**

科目名稱：商用統計學【企管系企管甲班碩士班甲組選考、乙組選考、丙組選考】題號：441002
※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　共2頁第1頁

一、填充題（共 20 個填空，每一個填空 2 分，合計 40 分）

1. Random variable X has a p.d.f. $f(x) = e^{-\pi x^2}$, $-\infty < x < \infty$。Then, the probability distribution of X is （①）, and Var $(\sqrt{2\pi}X + 2\pi) = $ （②）。

2. Random variable X is hyper-geometric distributed with parameters N, r, n。Then, it can be found that $E(X) = $ （③）, and $Var(X) = $ （④）

3. Random variable X, denoting the number of arrivals within a fixed time length, is a Poisson distribution with $Var(X) = 4$。Then, the inter-arrival time follows a （⑤）distribution in which $\mu = $ （⑥）, $\sigma = $ （⑦）.

4. Two random samples must satisfy three conditions as （⑧）, （⑨）, （⑩）in order for the sampling distribution of $\frac{s_1^2}{s_2^2}$ to be an F distribution。

5. In hypothesis testing, in order to measure how much the sample evidence is against H_0, we use （⑪）, and have it compared against （⑫）to decide to reject or not to reject H_0.

6. A production process is checked periodically by a quality control inspector. The inspector selects simple random samples of 49 finished products and computes the sample mean product weights $\overline{X}$. If test results over a long period of time show that 5% of the $\overline{X}$ values are over 2.1 kg and 5% are under 1.9 kg, then the mean is （⑬）and the standard deviation is （⑭）for the population of products produced with this process.

7. The current value of a high-tech company is \$320 million. If the value of the company 5 years ago was \$10 million, the company's mean annual growth rate over the past five years is （⑮）.

8. The desired margin of error for estimating a population proportion in national public opinion polls conducted by organizations such as Gallup and Harris is commonly chosen to be （⑯）.

9. An observation that does not fit the pattern of the other data is called （⑰）.

10. In logistic regression model, the （⑱）measures the impact on the odds of a one-unit increase in only one of the independent variables.

11. In stepwise regression procedure, if the p-value for any independent variable is （⑲）than an α-to-leave (the level of significance for determining whether to remove an independent variable from the model), the independent variable with the （⑳）p-value is removed from the model and the stepwise regression procedure begins a new step.

二、觀念解釋題（共 2 題；每題 10 分；合計 20 分）

1. Please explain why in regression analysis $F = {MSR}/{MSE}$ is used as the test statistic for F-test of $H_0: \beta_1 = \beta_2 = \cdots = \beta_p = 0$.

2. What is the randomized block design? What advantage can it have over the completely randomized design? Explain.

三、計算題（共 2 大題；合計 40 分）

1. Suppose the quarterly sales values for the four years of historical data are as follows. （共 5 小題，每小題 5 分；計 25 分）

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1	4.8	4.1	6.0	6.5
2	5.8	5.2	6.8	7.4
3	6.0	5.6	7.5	7.8
4	6.3	5.9	8.0	8.4

(a) Compute the four-quarter and centered moving average values for this time series.
(b) Compute the seasonal indexes for the four quarters.
(c) De-seasonalize the time series.
(d) The estimated linear trend equation is obtained as $\hat{y} = 5.104 + 0.1476t$, where $\hat{y}$ is the deseasonalized sales and t represents quarter t for t=1, …, 16. Assuming that this equation can be used to develop a trend projection for future quarters, compute the deseasonalized quarterly trend forecasts for the 4 quarters of year 5.
(e) Use the seasonal indexes in part (b) to adjust the de-seasonalized trend forecasts for the four quarters of year 5.

2. In a regression analysis involving 30 observations, the following estimated regression equation was obtained: （共 3 小題，每小題 5 分；計 15 分）
$$\hat{y} = 17.6 + 3.8x_1 - 2.3x_2 + 7.6x_3 + 2.7x_4$$
For this estimated regression equation SST=1805 and SSR=1760.

(a) At $\alpha = 0.05$, test the significance of the relationship among the variables.

Now, suppose that variables x_1 and x_4 are dropped from the model and the following estimated regression equation is obtained:
$$\hat{y} = 11.1 - 3.6x_2 + 8.1x_3$$
For this model SST=1805 and SSR=1705.

(b) Compute SSE(x_1, x_2, x_3, x_4) and SSE(x_2, x_3).
(c) Use an F test and a 0.05 level of significance to determine whether x_1 and x_4 contribute significantly to the model.

Some statistical tabled values are displayed as follow for your computations.
$F_{4, 25; 0.05} = 2.76$; $F_{4, 25; 0.025} = 3.35$; $F_{2, 25; 0.05} = 3.39$; $F_{2, 25; 0.025} = 4.29$
$F_{25, 4; 0.05} = 5.77$; $F_{25, 4; 0.025} = 8.50$; $F_{25, 2; 0.05} = 19.46$; $F_{25, 2; 0.025} = 39.46$